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AUTHOR Usova, George M.; Casteen, Dennis
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ABSTRACT

This guide presents established principles of learning and instruction, along with practical examples of how these principles can be incorporated into instructional materials. This guidebook is a collection of 55 of the more commonly known principles of learning. The principle statements are first arranged by category of learning. Each category contains several principles with citations of the author of the research and the date the research was published. An interpretation of the meaning of the statement immediately follows the principle. The application describes a specific and concrete use of the principle to the curriculum development process. In some instances graphics are provided to show how the principle would be applied in an actual lesson. The 17 categories are prelearning preparation, individual differences, instructional conditions, motivation, active participation, successful achievement, knowledge of results, practice, rate of presentation, vocabulary/technical terminology, diagnosis, remediation, learning concepts, presentation/format, memory/forgetting, questions, and review/summary. (YLB)

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PRINCIPLES OF LEARNING AND INSTRUCTION

George M. Usova, Ph.D.

Dennis Casteen

U.S. DEPARTMENT OF EDUCATION
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PRINCIPLES OF LEARNING AND INSTRUCTION

Purpose

The purpose of this guide is to present established principles of learning and instruction, along with practical examples of how these principles can be incorporated into instructional materials developed by the Shipyard Training Modernization Program.

In order to be effective, any form of instruction must be based upon proven methods and techniques. Learning is a complex mental process, and as such should not be approached in a casual or haphazard manner. The learning process has been studied extensively through research and experimentation, and any instruction developed by this program should give careful consideration to the collective findings of experts who have conducted such studies. Indeed, sound instructional development requires the application of such findings.

It is intended that IITs, SMEs, Training Specialists, and other members of the Modernization Program use this guide as a ready reference for instructional design and development principles when writing instruction. Incorporating proven instructional principles into our training materials will help ensure that the instruction we develop results in meaningful learning when it is delivered in the classroom.

Background

"There is nothing new under the sun." This is certainly a true statement with regard to the fundamental principles of learning and instruction. These principles have not changed; the understanding and application of them do. Many instructional developers tend to design instruction the way they were taught, even if the teaching they received was faulty. This natural tendency can be overcome by gaining an understanding of the reasons behind efficient

instructional development, and practice in the development of instructional materials based upon sound learning principles.

The basic question that must be asked and answered after training has been conducted is "Did the trainee learn the material in the lesson?" This most important question covers the entire purpose and reason for training to exist in the first place. To answer "yes" to this question requires the training developer to "bring to bear" and integrate within the training materials, the best of what we know about principles and practices of learning today. To this end, trainees are guaranteed the best success possible in learning.

Educational researchers have consistently supported the need for the incorporation of proven learning principles into instructional materials. The following statements are representative:

a. Designing instruction must be based upon knowledge of how human beings learn. (Gagne, Briggs, 1974)

b. It (the instructional process) is composed of many interrelated parts and functions that must operate in a coherent manner in order to achieve success. (Kemp, 1977)

c. Basic curriculum design principles for the development of instructionally effective courseware are known, and their effects have been sufficiently researched to demonstrate their value. (Futrell & Geisert, 1985)

Research findings like these confirm that if we design our instructional materials in accordance with proven principles of learning and instruction, the training materials we produce will provide an opportunity for real student learning in the classroom.

How to Use this Guidebook

To know how to do a job is not enough; performance is the measure of knowledge and skill. The principles that are listed in this guide must be incorporated into instructional materials where appropriate in order to achieve good design.

The principles of learning that follow are principles widely accepted by experts in the fields of education and training. These principles are, in fact, authoritative beliefs and practices which have been tested scientifically over the years and have become well-established truisms for guiding curriculum development.

This guidebook is a collection of 55 of the more commonly known principles of learning. The principle statements are first arranged by CATEGORY of learning. Each category contains several PRINCIPLES which cite the author of the research and the date the research was published to add authenticity and credibility to the statement. Immediately following the principle, is an INTERPRETATION of the meaning of the statement. In most cases, the interpretation may be obvious; however, it is included for clarification purposes. Finally, and perhaps most importantly, is the APPLICATION, which describes a specific and concrete use of the principle to the curriculum development process. In some instances illustrations are provided to show how the principle would be applied in an actual lesson. The structure of this presentation is shown in the example below:

EXAMPLE

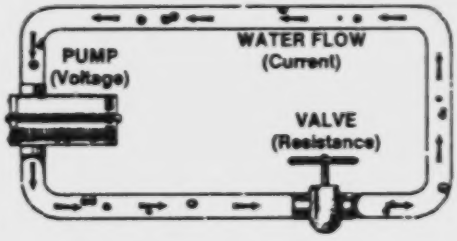
Category → Prelearning Preparation

Principle → Learning is made easier if it is built upon something already known. (Leighbody & Kidd, 1968)

Interpretation → USE EXAMPLES BASED ON COMMON EXPERIENCES AND KNOWLEDGE IF POSSIBLE.

Application → During instructional delivery, instructors should include analogies and examples that are based upon experiences common to everyone.

Illustration → *In teaching how voltage, resistance, and current operate in a circuit, the analogy of a water pump could be used.*



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PRINCIPLES OF LEARNING & INSTRUCTION

PRELEARNING PREPARATION

1. Students should have satisfactorily achieved learning that is prerequisite to a lesson. (Kemp, 1977)

STUDENTS SHOULD HAVE SUCCESSFULLY COMPLETED PREREQUISITE COURSES OR PRETESTS.

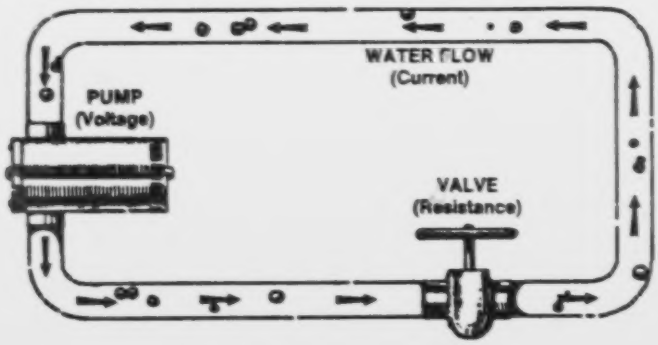
Instructional developers should ensure that the learner will have completed any preliminary training or passed specific pretests if the lesson content requires it.

2. Learning is made easier if it is built upon something already known. (Leighbody & Kidd, 1968)

USE EXAMPLES BASED ON COMMON EXPERIENCES AND KNOWLEDGE IF POSSIBLE.

During instructional delivery, instructors should include analogies and examples that are based upon experiences common to everyone.

In teaching how voltage, resistance, and current operate in a circuit, the analogy of a water pump could be used.



INDIVIDUAL DIFFERENCES

3. Student learning rates within a class or group may vary considerably. (Kemp, 1977)

TYPICAL CLASSROOMS INCLUDE STUDENTS WHO ARE WELL ABOVE AVERAGE IN ABILITY WITH STUDENTS WHO MAY ONLY HAVE MARGINAL ABILITY.

Training materials (IGs & SGs) as well as instructional delivery methods must adapt to individual learning abilities and rates.

4. Learning experiences should be designed so that students may proceed at their own pace. (Kemp, 1977)

CLASSROOM ACTIVITIES SHOULD BE PLANNED TO ALLOW STUDENTS TO PROGRESS AT THEIR OWN RATES, IF POSSIBLE.

IGs should include frequent opportunity for students to work on their own during practice or reading sessions.

INSTRUCTIONAL CONDITIONS

5. Successful learning is more likely when objectives are clearly stated for students. (Kemp, 1977)

STUDENTS NEED TO UNDERSTAND EXACTLY WHAT THEY ARE SUPPOSED TO LEARN.

IITs/SMEs need to give careful consideration to the selection and wording of lesson objectives. Instructors should discuss all lesson objectives with the students to ensure that they understand what they are supposed to learn.

6. Lesson content should be organized sequentially from simple to complex. (Kemp, 1977)

THE EASIEST TASKS AND KNOWLEDGES SHOULD BE PRESENTED TO STUDENTS FIRST.

IITs/SMEs should design lesson material that progresses from simple principles or tasks to more difficult ones, building upon incrementally known information.

7. Lesson content may be more completely learned if it is presented to the learner two or more times, in identical or varied forms. (Allen, 1973)

LESSON CONTENT CAN FREQUENTLY BE PRESENTED TO STUDENTS ORALLY, FOLLOWED BY A VISUAL PRESENTATION OR DEMONSTRATION.

Important information can be presented to the student in more than one way, i.e., written form followed by a practice session (hands-on).

8. It is useful to direct the learner's attention to particular elements of instructional messages through visual cueing or other attention-attracting devices. (Allen, 1973)

STUDENT ATTENTION CAN BE MAINTAINED BY USING COLORFUL ILLUSTRATIONS, WORKING MODELS, PERSONAL EXPERIENCE, ETC..

IITs/SMEs should include references to illustrations, demonstrations, working models, etc., when appropriate in IGs.

MOTIVATION

9. Perception of some personal value in a learning task will captivate student attention. (Kemp, 1977)

CLEARLY ILLUSTRATE THE RELATIONSHIP BETWEEN SUCCESSFUL ON-THE-JOB PERFORMANCE AND THE LESSON BEING TAUGHT.

Motivational activities should relate the material being taught to the personal benefit of the trainees, i.e., how they will gain from the instruction.

Illustration

Example

INSTRUCTOR GUIDE	MODULE 1
OUTLINE OF PRESENTATION	INSTRUCTOR/STUDENT ACTIVITY

MOTIVATION

This module on blueprint reading is very important to you as a mechanic in the shipyard. You will need to refer to blueprints in order to determine where on a ship a job must be done. Just imagine that right now your group leader would hand you a job order and the blueprint for the USS KENNEDY Aircraft Carrier and tell you to do the job requested on the job order! What would you do?

Discuss the purpose of this module. Describe an incident which requires the student to use blueprint reading skills and ask the students what they would do?

NOTE: This format shows the motivational strategy used in the Instructor Guide. This could be used as the beginning of a videotape. On the videotape a pause should be built in to allow for responses from the learners.

10. Student interest can be maintained by providing a variety of learning experiences. (Kemp, 1977)

CHANGE INSTRUCTIONAL METHODS REGULARLY DURING THE LESSON TO MAINTAIN STUDENT INTEREST.

IITs/SMEs should vary classroom activities within any given lesson as much as possible to hold student interest and attention.

11. Positive motivators include the use of color; dramatic presentations; humor and comic effects; and occasional questions. (May, 1965)

DRAMATIC ILLUSTRATIONS AND A GENUINE SENSE OF HUMOR CONTRIBUTE TO ANY PRESENTATION.

Lesson illustrations should be developed to include as much color and graphic impact as possible. Spontaneous humor and occasional questions serve to stimulate student interest.

ACTIVE PARTICIPATION

12. Learning must be performed. (Kemp, 1977)

PRACTICE SHOULD BE INCLUDED IN LESSON MATERIAL WHENEVER POSSIBLE.

IITs/SMEs should incorporate progress checks and practice exercises (mental or performance) into SGs prior to testing. Peformance tests should be used to measure learning whenever a skill is being taught.

13. For successful learning, students should be directed systematically to participation activities. (Kemp, 1977)

STUDENT PARTICIPATION MAY TAKE THE FORM OF ANSWERING QUESTIONS, WRITTEN RESPONSES, DEMONSTRATION, DISCUSSION, ETC..

IGs/SGs should contain student activities that require students to manipulate, practice, and/or rehearse information for improved retention and for knowledge/skill testing.

14. When a student participates frequently by responding actively to some stimulus, learning of the materials will be increased. (Allen, 1973)

STUDENTS SHOULD BE REQUIRED TO PARTICIPATE IN CLASSROOM ACTIVITIES WHENEVER POSSIBLE.

IGs/SGs should include frequent questions, progress checks, discussions, etc., that will require students to be involved in the learning process.

SUCCESSFUL ACHIEVEMENT

15. Learning must be structured in such a way that the student is mentally challenged and frequently successful. (Kemp, 1977)

DEVELOPMENT OF THE TRAINING PACKAGE INVOLVES MANY TEACHING-LEARNING VARIABLES THAT INTERACT TO PRODUCE EFFECTIVE INSTRUCTION.

IITs/SMEs should design lesson material to progress from easy to complex, with ample practice exercises, knowledge of results, and frequent praise so that students have the best opportunity for successful learning.

16. The instructor needs to plan his lesson so that successful learning is assured at each step of the way. (Leighbody & Kidd, 1968)

STUDENTS SHOULD BE GIVEN WRITTEN PROGRESS CHECKS AND OCCASIONAL ORAL QUESTIONS IN ORDER TO ASSESS THEIR KNOWLEDGE BEFORE INTRODUCING NEW KNOWLEDGE.

IGs/SGs should include frequent tests or assessments after each segment of learning rather than mass testing at the end of the lesson.

17. Successful learning stimulates more learning. (Leighbody & Kidd, 1968)

STUDENTS SHOULD BE GIVEN WRITTEN PROGRESS CHECKS AND OCCASIONAL ORAL QUESTIONS IN ORDER TO ASSESS THEIR KNOWLEDGE.

Progress checks should immediately follow the lesson material segments being taught with appropriate feedback and reinforcement and not grouped together at the end of a lesson.

KNOWLEDGE OF RESULTS

18. Students should be informed of how well they are doing during the course of a lesson. (Kemp, 1977)

RESULTS OF STUDENT PERFORMANCE SHOULD BE GIVEN TO THE LEARNER IMMEDIATELY.

When progress checks, practice exercises, or job sheets are completed, student answers/performance should be reviewed and compared with correct answers/performance.

19. It is important that both teacher and learner know that the learner has really learned. (Leighbody & Kidd, 1968)

QUESTIONING AND STUDENT DEMONSTRATIONS CAN BE USED TO VERIFY STUDENT LEARNING.

The incorporation of frequent questions into IGs/SGs can serve to verify that students are learning.

20. The sooner the learner can know he has learned something, the more ready he is for further learning. (Leighbody & Kidd, 1968)

RESULTS OF STUDENT PERFORMANCE SHOULD BE GIVEN TO THE LEARNER IMMEDIATELY.

When progress checks, practice exercises, job sheets, or final tests are completed by the students, the results should be reviewed and discussed immediately.

PRACTICE

21. Practice in attaining concepts increases the ease with which new concepts are attained. (Scholl, 1966)

WHENEVER POSSIBLE, STUDENTS SHOULD BE GIVEN THE OPPORTUNITY TO PRACTICE NEW PROCEDURES OR SKILLS.

IITs/SMEs should include frequent opportunity for practice in IGs/SGs, particularly when a skill is being taught.

22. Learning will increase if a student practices a skill while it is being demonstrated, provided periods of time are allowed for this purpose. (Hoban & Van Ormer, 1950)

STUDENTS SHOULD BE ALLOWED TO PRACTICE IMMEDIATELY FOLLOWING A DEMONSTRATION BY THE INSTRUCTOR.

Practice sections in the SG should immediately follow demonstration sections in the IG.

23. The practical implication that a DP (distributed practice) session leads to a significant reduction in the A-state (anxiety) level of high A-trait students is that there may be ways to control the anxiety provoking aspects of test-like situations by altering the way a student studies and rehearses the material to be learned. (Waid et al, 1978)

THE USE OF WELL DESIGNED LESSON MATERIALS, WITH PROPERLY SPACED OPPORTUNITIES FOR PRACTICE CAN IMPROVE STUDENT ATTITUDES AND PERFORMANCE DURING TEST SITUATIONS.

IITs/SMEs should provide ample opportunity for student study and practice when designing lesson materials.

24. The child does fewer examples, but does examples at the level of his competence, without the teacher having to be involved in choosing the examples. (Barr, 1977)

LEARNERS CAN BE PRESENTED WITH SEVERAL ALTERNATIVES FOR PRACTICE, WITH THE OPPORTUNITY TO CHOOSE ONE THEMSELVES.

When constructing practice exercises, progress checks, or job sheets IITs should consider providing multiple possibilities and directing the student to choose one on his own.

RATE OF PRESENTATION

25. The rate and amount of learning in a lesson is related to the complexity of the material in terms of student ability. (Kemp, 1977)

DIFFICULT MATERIAL SHOULD BE INTRODUCED MORE SLOWLY THAN RELATIVELY SIMPLE SKILLS AND KNOWLEDGES.

Lessons should be broken into two or more modules if a lot of difficult information is to be addressed.

26. Short segments of lesson content with many opportunities for student participation, practice, and self-testing are most effective. (Kemp, 1977)

LESSON MATERIAL SHOULD BE PRESENTED IN SHORT SEGMENTS, ALLOWING THE STUDENT TIME TO COMPREHEND THE NEW INFORMATION.

SG design should favor short information sections followed by practice exercises, progress checks, job sheets, etc..

27. The simultaneous use of two senses (visual and audio) in video is likely to be of value only when the rate of input of information is very slow. (Travers, 1966)

COMPLEX INFORMATION IS MORE EASILY LEARNED WHEN BOTH SENSES ARE INVOLVED.

Script Writers/TV Production Specialists should judiciously apply both audio and visual displays when the information to be presented is complex and requires a slower, more deliberate pace.

VOCABULARY/TECHNICAL TERMINOLOGY

28. Authorities on the teaching of vocabulary generally agree that words chosen to be taught should be related to each other and should be personalized for the student. (Fillmer, 1977)

THE VOCABULARY USED IN LESSON MATERIAL SHOULD BE LIMITED TO THE SUBJECT AT HAND AND DEFINED BY USING TERMS/EXAMPLES FAMILIAR TO THE STUDENT.

IITs/SMEs should limit entries into IG/SG glossaries to words that are related to the subject material. Definitions should include words or comparisons that the students are already familiar with.

29. Unfamiliar words may cause the reader to skip over such words or even whole sections containing such words, which are judged to be difficult or not vital to the progress of the lesson. (Freebody and Anderson, 1983)

UNFAMILIAR OR NEW WORDS IN LESSON MATERIAL MAY CAUSE STUDENTS TO SKIP WHOLE SENTENCES OR PARAGRAPHS CONTAINING IMPORTANT INFORMATION.

IGs should direct the instructor to introduce and define new terminology before the student encounters it in the lesson materials. The Glossary should be an integral and functioning component of the lesson.

Use SHORT, FAMILIAR words when possible.

Poor Choice	*Better Choice*
accordingly	*so*
assistance	*help, aid*
facilitate	*help, ease*
utilization	*use*
feasible	*possible*
implement	*carry out*

30. It appears that the importance that experience has long been supposed to play in the development and maintenance of word meaning should be reflected in the day-to-day business of teaching vocabulary in our schools. (Duffelmeyer, 1980)

NEW TERMS SHOULD BE DEFINED TO THE STUDENT USING WORDS OR EXPRESSIONS THAT HAVE BEEN ACQUIRED THROUGH LIFE EXPERIENCES.

Word definitions in IG/SG glossaries should include references to ideas/concepts that have been learned through common experience.

31. Technical terminology is the single most important determinant of comprehension. (Usova, 1977)

KNOWLEDGE OF THE TERMS IN A LESSON IS ESSENTIAL TO UNDERSTANDING MEANINGS, AND ULTIMATELY TO THE APPLICATION OF SKILLS.

IITs/SMEs should develop glossaries in all training packages as well as reference and define technical terminology as it is introduced throughout the lesson.

DIAGNOSIS

32. Instructors must consider each student individually and regard each instructional procedure as a hypothesis that must be tested to determine its effectiveness for a particular student. (Wesson and Skiba, 1984)

AN INSTRUCTIONAL METHOD DOES NOT ACHEIVE THE SAME RESULTS WITH ALL STUDENTS: INDIVIDUAL PERFORMANCE MUST BE EXAMINED.

When designing remedial instruction IITs should remember that one form of instruction may not be suitable for all students.

33. ... one of the crucial decision and diagnostic concerns of the instructor will be to determine the appropriate learning style for an individual. (Fennell, 1984)

ONE OF THE MOST IMPORTANT DECISIONS AN INSTRUCTIONAL DESIGNER HAS TO MAKE IS TO DETERMINE THE MOST EFFECTIVE LEARNING METHOD FOR A STUDENT.

IITs/SMEs should give careful consideration to the learner's individual abilities when selecting an instructional method in designing instruction.

34. When the educational outcomes are negative (-) the educator needs to repeat the systematic process -- reassess, rediagnose, redesign -- to determine ways in which learning can be facilitated. (Ostwald and Williams, 1985)

WHEN TEST RESULTS ARE CONSISTENTLY POOR, THE EDUCATOR NEEDS TO REEXAMINE THE COURSE INSTRUCTIONAL DESIGN TO DETERMINE WHAT METHODS COULD BE INCORPORATED FOR IMPROVEMENT.

IITs/SMEs should carefully reevaluate the design of instructional materials if student achievement is significantly below what was expected.

REMEDIATION

35. Achievement can be significantly and positively influenced through diagnostic/remedial instruction. (Yeany and Miller, 1983); The implementation of strategies (remediation) can significantly improve the achievements of average and low ability students. (Idar and Ganiel, 1985)

REMEDIATION HAS BEEN SHOWN TO BE EFFECTIVE IN IMPROVING THE PERFORMANCE OF AVERAGE AND LOW ABILITY STUDENTS.

IITs/SMEs should develop alternate forms of instruction to be used in the event of student failure or poor performance.

36. Education should consider the specific reading difficulties and vocational needs of the student when selecting materials for remediation. (Brown and Chang, 1982)

EDUCATORS SHOULD CONSIDER THE SPECIFIC READING LEVEL AND SKILL REQUIREMENTS OF STUDENTS WHEN DESIGNING REMEDIAL INSTRUCTION.

IITs/SMEs should consider student reading level and specific trade requirements when selecting methods for remedial instruction.

LEARNING CONCEPTS

37. Concepts of concrete objects appear to be more readily formed than some more abstract concepts, e.g., concepts of spatial forms and of numbers. (Clark, 1971)

STUDENTS UNDERSTAND LESSON MATERIAL THAT DEALS WITH PRACTICAL SKILLS OR ABILITIES BETTER THAN THOSE THAT DEAL WITH THEORY.

When designing lesson materials for teaching theory, IITs/SMEs should include examples that use practical knowledge or skill whenever possible.

38. Choose both examples and non-examples for instruction. (DeCecco, 1968)

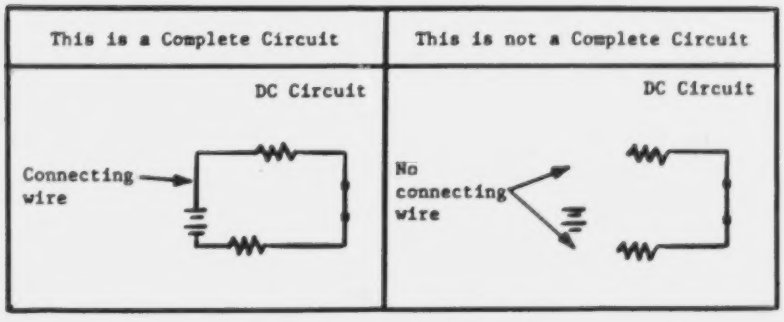
INSTRUCTIONAL MATERIAL SHOULD INCLUDE EXAMPLES THAT ARE SYNONYMOUS WITH THE SKILL/CONCEPT BEING TAUGHT AND EXAMPLES THAT ARE NOT SYNONYMOUS SO THAT TRAINEES CAN DIFFERENTIATE.

Examples provided in IGs/SGs should be used in conjunction with illustrations/activities that are not representative of the skill/concept being taught.

Illustration

DEFINITION OF A COMPLETE CIRCUIT:
A complete circuit has the following characteristics

1. *Voltage source.*
2. *Connecting wires.*
3. *Load or loads.*
4. *Unbroken electron path.*



39. Prior learning of relevant words, e.g., names of attributes, of examples, or of concepts, can facilitate concept learning. The same would hold for prior encounter with relevant objects, events, or relations. (Clark, 1971; Klausmeier, Ghatala, and Frayer, 1974)

PREVIOUS EXPOSURE TO SUBJECT TERMS, CHARACTERISTICS, CONCEPTS, ETC., CAN PROMOTE LEARNING.

IITs/SMEs should include references to previously learned skills/knowledges whenever possible.

40. There is evidence that examples in verbal form facilitate concept learning over those in picture form, presumably because the former exhibit fewer irrelevant attributes. Similarly, simplified examples such as line drawings, cartoons, charts, and diagrams have been found more effective than realistic pictures. (DeCecco, 1968)

CONCISE LECTURE, SIMPLE DRAWINGS, AND CHARTS COMMUNICATE MORE EFFECTIVELY THAN PHOTOGRAPHS OR ELABORATE ILLUSTRATIONS.

IITs/SMEs should favor the use of brief outlines, simple line drawings, and charts when designing instruction that is intended to teach a basic concept or principle.

41. Use of the concept name in contiguity with each presented example facilitates concept learning. (DeCecco, 1968)

THE NAME OF A CONCEPT SHOULD BE INCLUDED IN EVERY EXAMPLE OR ILLUSTRATION THAT IS USED DURING THE INSTRUCTION OF THAT CONCEPT.

IITs/SMEs should ensure that concept names are included whenever an example/illustration is presented to the student.

PRESENTATION/FORMAT

42. Presenting examples in close succession or simultaneously in small groups, and keeping previous examples in view while others are added facilitate concept acquisition. (DeCecco, 1968)

EXAMPLES SHOULD BE PRESENTED TO THE STUDENT IN A SERIES. RELATED EXAMPLES SHOULD REMAIN ON DISPLAY WHILE NEW ONES ARE INTRODUCED.

Examples (demonstrations/illustrations) in IGs should be grouped together. Related examples should remain in view while new ones are introduced and discussed.

43. Presenting a definition as a list of critical attributes can facilitate concept acquisition over presenting it in typical sentence form. (Markle, 1975)

DEFINING A TERM BY USING A LIST OF CHARACTERISTICS IS MORE EFFECTIVE THAN USING A SENTENCE DEFINITION. THE VERTICAL OR TABULAR PRESENTATION IS MORE EASILY LEARNED THAN THE HORIZONTAL FORMAT WHICH TENDS TO HIDE OR EMBED MEANINGS.

Where possible, IITs/SMEs should define technical terms/concepts by listing characteristics/attributes instead of using sentence definitions.

44. Where learners verbalize the criterial attributes of the concept name, learning is increased. (Clark, 1971)

PRACTICE BY VERBALIZING THE CHARACTERISTICS/ELEMENTS OF A CONCEPT IMPROVES STUDENT LEARNING.

IITs/SMEs should include exercises in IGs that require students to recite or discuss important elements/characteristics of a new concept or principle.

45. Where learners put newly-formed concepts to use, the concepts will be better learned. (Klausmeier, Ghatala, and Frayer, 1974)

LEARNING IS INCREASED WHEN STUDENTS ARE REQUIRED TO USE NEWLY LEARNED CONCEPTS, SKILLS, OR PRINCIPLES.

IGs/SGs should include practice exercises that require students to use new skills or knowledges immediately.

46. Isolation Effect: When a list contains a few items that are different from the majority of items the different items are learned more quickly. (Ebbinghaus, 1885)

ATTENTION IS DRAWN TO THOSE ITEMS THAT APPEAR DIFFERENT.

Information presented in IGs/SGs should be highlighted or separated in some manner to draw trainee attention to those areas most important for retention.

MEMORY/FORGETTING

47. Subjects learn best the first and last items on a list. They learn most slowly the items in the middle of the list. (Ebbinghaus, 1885)

STUDENTS REMEMBER BEST MATERIAL THAT IS PRESENTED TO THEM FIRST AND LAST DURING CLASSROOM INSTRUCTION.

IITs/SMEs should present more important information at the beginning and end of a lesson or listing.

48. Only five to nine new items can be retained at any one time in short-term memory. (Miller, 1956)

STUDENTS CANNOT RETAIN MORE THAN NINE NEW PIECES OF INFORMATION DURING A TYPICAL CLASSROOM SESSION.

Test items should not require the recall of more than nine specific items. Job aids should be used as a possible option when memory requirements exceed human performance.

49. Material must be reviewed within half an hour after learning to test for successful retrieval. (Miller, 1956)

NEW INFORMATION PRESENTED TO THE STUDENT MUST BE SUMMARIZED HALF AN HOUR AFTER PRESENTATION TO VERIFY RETENTION.

SG progress checks should address information that has just been presented to the student rather than leaving testing to the end of the lesson when forgetting has occurred.

50. Common errors can be taught and illustrated through text material to teach dangers, hazards, or frequent mistakes; however, the proper method or procedure should be presented last. (Usova, 1985)

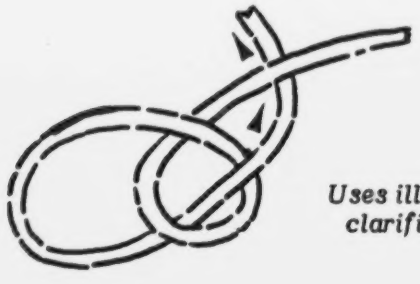
THE LAW OF RECENCY STATES THAT INFORMATION LEARNED LAST IS BETTER RECALLED, REDUCING THE PROBABILITY OF LEARNING THE INCORRECT FORM.

In IGs/SGs, scripts, and videotapes, always present the proper procedure, method, or example after presenting the common error so that the trainee recalls last the correct form.

Illustration

Cross the end of the line under the main part of the line.

It is easy to confuse this step and cross the end over the main part of the line. Be sure you cross under.



Points out common errors

Uses illustrations for clarification

QUESTIONS

51. Questions posed before instruction can improve learner retention and enhance recall. (Reynolds, Standiford and Anderson, 1979)

QUESTIONS ASKED BEFORE A LESSON CAN HELP STUDENTS LEARN AND RETAIN NEW INFORMATION.

IITs/SMEs should include questions at the beginning of lesson presentations.

52. Questions posed during instructional delivery have long been recognized as an effective learning aid. (Hall, 1983)

QUESTIONS ASKED DURING A LESSON HELP IMPROVE STUDENT LEARNING.

IITs/SMEs should include frequent questions in the lesson presentation section of IGs.

53. When a student participates frequently by responding actively to some stimuli (questions), learning of the materials will be increased. (Allen, 1973)

STUDENT PARTICIPATION IN CLASSROOM ACTIVITIES INCREASES LEARNING.

Question/answer sessions should be incorporated into IGs/SGs whenever appropriate.

REVIEW/SUMMARY

54. Explicit topic sentences make a difference in key idea inclusion, and explicit topic sentences highlighted lexically make a difference in integration of key ideas. (Garner and McCaleb, 1985)

WELL WRITTEN OUTLINE/PROSE WITH CLEARLY DEFINED TOPIC SENTENCES IMPROVES STUDENT COMPREHENSION.

When writing outlines/narration IITs/SMEs should ensure that topic sentences are easily recognized, possibly by the use of bold print.

55. The ability to identify important elements in a passage is a strategic skill that underlines both summarization and comprehension. (Winograd, 1984)

GOOD SUMMARIZATION REQUIRES THE ABILITY TO GLEAN LESSON MATERIAL AND ELIMINATE EXTRANEOUS INFORMATION.

IG summaries should include only pertinent information that can be listed in a concise fashion.

Summary

What guidelines should be used during the design of instructional materials? What standards should be used to measure the quality of developed training materials? How can we determine if the instruction we develop is effective? Guidelines, standards, and effectiveness can all be defined by the application of established principles of learning such as those presented in this guide. Applying principles that are based upon research, conducted by experts in the field, is a sure way to improve the design and effectiveness of training materials that are produced by the Modernization Program.

The principles that have been presented here from 16 categories of learning and instruction provide an excellent foundation on which to build instructional materials. It should be remembered however, that "learning must be performed" (principle number 12 in this booklet), and that it is incumbent upon instructional developers in the Shipyard Training Modernization Program to apply these principles when writing instruction. By incorporating these principles, each member of the modernization team can help ensure that when our training materials are used in the classroom, they are truly effective.

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